SI: ICONIP 2015: Neural networks: theory, design and applications

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As one of the top conferences on neural networks and intelligent computation, the 22. International Conference on Neural Information Processing (ICONIP 2015) was successfully held in Istanbul, Turkey, from November 9 to 12, 2015, and covered wide ranges of topics on researches and applications of neural network in various fields. To continue such success, a special issue is launched on “Neural Networks: Theory, Design and Applications,” with 19 high-quality papers selected from ICONIP 2015 in Neural Computing and Applications.

The purpose of this special issue is to track the latest process of researches and applications of neural networks. We are pleased to have different scholars from different regions in Asia–Pacific to contribute to this special issue. Eventually, seven papers are included in this issue.

S. Kurogi et al. present a method of probabilistic prediction of chaotic time series. The method employs learning machines involving strong learners capable of making predictions with desirably long predictable horizons, where, however, usual ensemble mean for making representative prediction is not effective when there are predictions with shorter predictable horizons. Thus, the method selects a representative prediction from the predictions generated by a number of learning machines involving strong learners as follows: first, it obtains plausible predictions holding large similarity of attractors with the training time series and then selects the representative prediction with the largest predictable horizon estimated via LOOCV (leave-one-out cross-validation). The method is also capable of providing average and/or safe estimation of predictable horizon of the representative prediction.

M.A. Hazar et al. evaluate the performances of different machine learning algorithms for automatic modulation recognition (AMR). Specifically, they evaluate the performances of artificial neural networks (ANN), support vector

machines (SVM), random forest tree, k-nearest neighbor (k-NN), Hoeffding tree, logistic regression, naive Bayes and gradient boosted regression tree (GBRT) methods to obtain comparative results. The most preferred feature extraction methods in the literature have been used for a set of modulation types for general-purpose communication. They consider AWGN and Rayleigh channel models evaluating the recognition performance as well as having made recognition performance improvement over Rayleigh for low SNR values using the reception diversity technique.

H. Ma and D. Wang study how to preserve connectivity for nonlinear time-delayed multiagent systems using event-based mechanism. By using the idea of divide-and-conquer, they divide the distributed controller into five parts to deal with different requirements of the time-delayed multiagent systems, such as eliminating the negative effects of time delays, preserving connectivity, learning the unknown dynamics and achieving consensus. To reduce the communication times among the agents, a centralized event-based protocol is introduced and an event-triggered function is devised to control the frequency of the communication without Zeno behavior. The technique of sigma functions is used to exclude the singularity of the established distributed controller.

Y. Guo et al. propose a new strategy for abstracting and restoring trajectories from the perspective of signal processing. That is, trajectories are treated as signals that bear copious information that varies with time and space, and information filtering is exploited to concisely communicate the trajectory data. As for trajectory abstraction, the resampling of trajectory data is first introduced based on achieving the minimum Jensen–Shannon divergence of the trajectories before and after being resampled. Then, a non-local filtering approach is developed to perform wavelet transformations of similarity groups of these resampled trajectories to produce the trajectory summaries. Trajectory abstraction can not only offer multigranularity summaries of trajectory data, but also identify outliers by utilizing a probabilistic definition of a group of trajectories and the Shannon entropy. Furthermore, to handle incomplete trajectory data for which some sample points are lost, the

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proposed non-local filtering idea is exploited to restore the incomplete data.

H. Wang et al. address the analog optimization for nondifferentiable functions. They use the Lagrange programming neural network (LPNN) approach to build analog neural networks for handling constrained optimization problems. Since this method may not be able to handle nondifferentiable functions, the authors also employ the least absolute shrinkage and selection operator (LASSO), where the constraint is nondifferentiable. This work considers the hidden state concept from the local competition algorithm (LCA) to formulate an analog model for the LASSO problem. Hence, the nondifferentiable limitation of LPNN can be overcome. Under some conditions, at equilibrium, the network leads to the optimal solution of the LASSO. They also prove that these equilibrium points are stable.

Y. Li and P. Gao propose a new approach, called marginalizing out hidden layer noise (MHLN), in which the predictor of single-hidden-layer feedforward neural networks (SLFNs) is trained with infinite samples. First, MHLN augments the training set in the hidden layer space with constrained samples, which are generated by corrupting the hidden layer outputs of the training set with given noise. For any given training sample, when the number of corruptions is close to infinity, according to the weak law of large numbers, the explicitly generated constrained samples can be replaced with their expectations. In this way, the training set is implicitly extended in the hidden layer space by an infinite number of constrained samples. Then, MHLN constructs the predictor of SLFNs by optimizing the expected value of a quadratic loss function under the given noise distribution. They show that MHLN achieves better generalization ability.

Y. Chen et al. study multidimensional networks that widely exist in various fields in the real world, such as sociology, chemistry, biology and economics. One of the

fundamental tasks of multidimensional network analysis is to explore network structure, including assortative structure (i.e., community structure), disassortative structure (e.g., bipartite structure) and mixture structure, that is, to find structural regularities in networks. There are two aspects of structural regularity exploration: (1) group partition—how to partition nodes of networks into different groups; and (2) group number—how many groups in networks. Most existing structural regularity exploration methods for multidimensional networks need to pre-assume the structure type (e.g., the community structure) and to give the group number of networks, among which the structure type is a guide to group partition. However, the structure type and group number are usually unavailable in advance. To explore structural regularities in multidimensional networks well without pre-assuming which type of structure they have, the authors propose a novel feature aggregation method based on a mixture model and Bayesian theory, called the multidimensional Bayesian mixture (MBM) model. In order to automatically determine the group number of multidimensional networks, the authors further extend the MBM model using Bayesian nonparametric theory to a new model, called the multidimensional Bayesian nonparametric mixture (MBNPM) model. The experiments conducted on a number of synthetic and real multidimensional networks show that the MBM model outperforms other related models on most networks and the MBNPM model is comparable to the MBM model.

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